LAWRENCE LIVERMORE
REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, Nov. 8-12, 2010

From dirty coal to a clean future

Julio Friedmann

The proposals to curtail the use of coal come in two forms: ways to capture carbon dioxide before it can escape into the air and ways to reduce the carbon dioxide that coal produces when burned.

In "post-combustion" systems, the coal is burned normally, but then chemical or physical processes separate carbon dioxide from the plume of hot flue gas that comes out of the smokestack. Once "captured" as a relatively pure stream of carbon dioxide, this part of the exhaust is pressurized into liquid form and then sold or stored (sequestration).

Apart from research projects, only two relatively small coal-fired power plants now operate in America with post-combustion capture.

But Julio Friedmann, head of LLNL's Carbon Management Program, is looking to change that. He has become one of the world's experts on sequestration, and where carbon dioxide can safely be stored underground.

Friedmann is working close with China, a country that is fast-tracking carbon capture and sequestration in all new power plants. Yet, Friedmann asks how quickly geologists from America and elsewhere can work with their counterparts in China to improve systems for pumping carbon dioxide underground, and to identify the right rock formations where it can safely be stored.

To read more, go to the Web.

Lab garners Editors Award at R&D100 awards ceremony

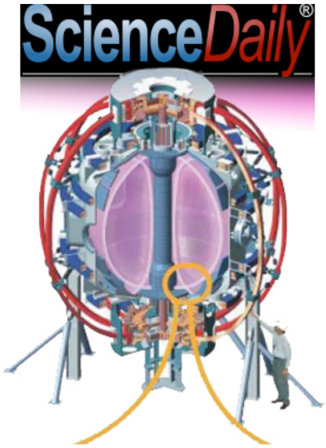
Hyung Gyu Park and Francesco Fornasiero helped develop carbon nanotubes.

For the second consecutive year, the Laboratory has won a coveted Editors Award at the annual R&D100 Awards presentation, sponsored by *R&D Magazine*. This year, the honor went to Hyung Gyu Park and Francesco Fornasiero for their work developing nanostructured membranes for water purification. The technology has been licensed to Porifera Inc. of Hayward.

In all, the Lab received six awards at a black tie ceremony in Orlando, Fla. on Thursday evening. LLNL's other winning entries were: Energy Monitor for Ultrahigh-Brightness X-Ray Pulses; High Performance Strontium Iodide Scintillator for Gamma Ray Spectroscopy; MEMS-based Adaptive Optics Optical Coherance Tomography; GATOR: Grating Actuated Transient Optical Recorder; and SRaDS: Statistical Radiation Detection System.

The Lab has now captured a total of 135 R&D 100 awards.

A snowflake by any other name . .



This is a "snowflake" divertor -- a novel plasma-material interface

. . . May also be a tool for taming thermonuclear plasma.

Lab physicists working on the National Spherical Torus Experiment (NSTX) at the Princeton Plasma Physics Laboratory are now one step closer to solving one of the grand challenges of magnetic fusion research -- how to reduce the effect that the hot plasma has on fusion machine walls (or how to tame the plasma-material interface).

Some heat from the hot plasma core of a fusion energy device escapes the plasma and can interact with reactor vessel walls. This not only erodes the walls and other components, but also contaminates the plasma. One method to protect machine walls involves divertors, chambers outside the plasma into which the plasma heat exhaust (and impurities) flow. A new divertor concept, called the "snowflake," has been shown to significantly reduce the interaction between hot plasma and the cold walls surrounding it.

While the conventional magnetic X-point divertor concept has existed for three decades, a very recent theoretical idea and supporting calculations by Lab physicist Dmitri Ryutov have indicated that the "snowflake divertor" would have much improved heat handling characteristics for the plasma-material interface.

The name is derived from the appearance of magnetic field lines forming the magnetic interface.

To read more go to the Web.

Giga-pixel pictures on small screens

Laboratory and University of Utah computer scientists have developed software that quickly edits "extreme resolution imagery" -- huge photographs containing billions to hundreds of billions of pixels or dot-like picture elements.

Before the new discovery, it took hours to process these "gigapixel" (equal to 100 photos from a 10-megapixel, or 10 million pixels, digital) images. The new software needs only seconds to produce preview images useful to doctors, intelligence analysts, photographers, artists, engineers and others.

By sampling only a fraction of the pixels in a massive image -- for example, a satellite photo or a panorama made of hundreds of individual photos -- the software can produce good approximations or previews of what the fully processed image will look like.

That allows someone to interactively edit and analyze massive images -- pictures larger than a gigapixel (billion pixels) - in seconds rather than hours, says Valerio Pascucci, an associate professor of computer science at the University of Utah and its Scientific Computing and Imaging (SCI) Institute, as well as a former LLNL computer scientist, who worked with current LLNL computer scientist Timo Bremer.

To read more, go to the Web.

Purple supercomputer fades to black

ASC Purple, the first supercomputer capable of routinely producing the three-dimensional simulations of nuclear weapons performance that underpin stockpile stewardship, was retired in a Terascale Simulation Facility ceremony this week.

Delivered in 2005, the IBM Purple machine represented the culmination of the Accelerated Strategic Computing Initiative's (ASCI) nearly 10-year quest to bring online a machine capable of performing 100 teraFLOP/s (trillions of floating point operations per second), regarded by scientists and engineers as the minimum threshold for reliable 3D nuclear weapons performance simulations. The Stockpile Stewardship Program is tasked to ensure the safety and viability of the nation's aging nuclear deterrent without testing.

The Purple system was the first national computational user facility available to scientists and engineers at the three nuclear weapons labs that make up ASC: Los Alamos, Sandia and Lawrence Livermore national labs.

To read more, go to the Web.
